

Remarks

Status of the Claims

Claims 21-48 are pending in the application, of which claims 21 and 36 are in independent form.

35 U.S.C. § 112, First Paragraph Rejection – Written Description Requirement

Claims 34-35 and 46-47

Claims 34-35 and 46-47 stand rejected under 35 U.S.C. § 112, first paragraph, as allegedly containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor, at the time the application was filed, had possession of the claimed invention. The Office action states that “the application as originally filed lacks support for the claim language directed to ‘a material that shrinks when molded to thereby generate a tension that pulls the breech portion and the muzzle portion toward each other’ (claims 34 and 46) and ‘in which the tension is opposed by a compression force exerted on the sleeve’ (claims 35 and 47).” Office action at p. 2, ¶ 2. Applicant respectfully traverses this rejection and asserts that the Office action fails to meet the initial burden of presenting reasons why a person skilled in the art would not recognize that the written description provides support for the claims. *See generally* MPEP 2163(II)(A).

The specification discloses, in one embodiment, a firearm barrel in which “the breech portion 18, insert member 36, sleeve 38 and muzzle portion 30 are supported in injection molding equipment 44 that permits the injection molding of the casing 40.” Specification, ¶ [0018] and FIG. 4 (Preliminary Amendment dated March 9, 2004). The specification also discloses that the casing 40 may be made of a thermoplastic copolymer or polymer blend, such as UT1018 Makroblend. *Id.* Such polymers are known in the art to shrink when cooled during molding. *See Exhibit A* (copy of Makroblend UT1018 data sheet) at page 3. Moreover, the specification expressly discloses a casing “made of a blend of polymers and carbon fibers which results in a low shrink rate.” Specification, ¶ [0018]. The specification also recites that “the optional serrations 28 and 34 assist in maintaining a tight connection between the casing 40, the breech portion 18 and the muzzle portion 30.” *Id.* As the casing material shrinks, a tension force would naturally be

created in the casing 40 (which pulls the breech portion and muzzle portion toward each other) and this tension would then exert a compression force on the sleeve 38. These opposing tension and compression forces create a firearm barrel which may be resistant to bending when exposed to lateral loads. In summary, a person skilled in the art would realize after reading the specification that “the casing is molded of a material that shrinks when molded” thereby generating a tension “that pulls the breech portion and the muzzle portion toward each other.” (quoting claim 34). Accordingly, applicant asserts that claims 34-35 and 46-47 are supported through both express and implicit disclosure. *See generally* MPEP 2163(I)(B).

Claim 43

Claim 43 is also rejected under 35 U.S.C. § 112, first paragraph, as allegedly containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor, at the time the application was filed, had possession of the claimed invention. The Office action states that “the application as originally filed lacks support for the claimed ‘the muzzle portion includes a minor bore and a major bore, the insert member inserted into the minor bore and the sleeve inserted into the major bore’ (claim 43).” Office action at p. 2, ¶ 2. Applicant respectfully traverses this rejection and asserts that the Office action fails to meet the initial burden of presenting reasons why a person skilled in the art would not recognize that the written description provides support for the claims. *See generally* MPEP 2163(II)(A).

The specification discloses, among other things, that “[t]he barrel 14 also includes an elongated metal insert member 36 which is received by bores formed in the breech portion 18 and the muzzle portion 30 as shown in FIG. 3.” Specification, ¶ [0016]. In addition, the specification discloses that “[t]he breech portion 18 has an interior bore within the step 26 capable of receiving the sleeve 38, so that the sleeve 38 is inserted within a portion of the breech portion 18 and adhered to the breech portion 18.” Specification, ¶ [0017]. Furthermore, the specification discloses that “the muzzle portion 30 may also have an interior bore within the stem 32 to accommodate the sleeve 38.” *Id.* (as amended). Although this embodiment is not shown in the drawings, a person skilled in the art would realize after reading the specification that a firearm barrel according to the disclosure may have a muzzle portion as claimed in claim 43, which “includes a minor bore and a major bore, the insert member inserted into the minor bore and the sleeve

inserted into the major bore.” (quoting claim 43). Therefore, applicant asserts that claim 43 is supported through express disclosure. *See generally* MPEP 2163(I)(B).

35 U.S.C. § 112, First Paragraph Rejection – Enablement Requirement

Claims 34-35 and 46-47

Claims 34-35 and 46-47 stand rejected under 35 U.S.C. § 112, first paragraph, as allegedly containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. The Office action states that “[t]he application as originally filed lacks support for the claim language directed to ‘a material that shrinks when molded to thereby generate a tension that pulls the breech portion and the muzzle portion toward each other’ (claims 34 and 46) and ‘in which the tension is opposed by a compression force exerted on the sleeve’ (claims 35 and 47).” Office action at p. 2, ¶ 3. Applicant respectfully traverses this rejection and asserts that the Office action fails to meet the initial burden of presenting reasons why a person skilled in the art would not be able to make and use the claimed invention without undue experimentation. *See generally* MPEP 2164.04 (the analysis and conclusion of a lack of enablement must be based on at least some of the *Wands* factors discussed in MPEP § 2164.01(a); the language should focus on those factors, reasons, and evidence that lead the examiner to conclude that the specification fails to teach how to make and use the claimed invention without undue experimentation).

As discussed *supra*, knowledge of injection molding of plastics would be within the knowledge of a person skilled in the art. The specification also discloses the use of a molded plastic material for casing 40 that shrinks when molded to result in the claimed structure. Accordingly, applicant asserts that the application as originally filed teaches how to make and use the invention claimed in claims 34-35 and 46-47 without undue experimentation.

Claim 43

Claim 43 is also rejected under 35 U.S.C. § 112, first paragraph, as allegedly containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. The Office action states that “the application as

originally filed lacks support for the claimed ‘the muzzle portion includes a minor bore and a major bore, the insert member inserted into the minor bore and the sleeve inserted into the major bore’ (claim 43).” Office action at p. 3, ¶ 3 (carryover). Applicant respectfully traverses this rejection and asserts that the Office action fails to meet the initial burden of presenting reasons why a person skilled in the art would not be able to make and use the claimed invention without undue experimentation. *See generally* MPEP 2164.04

Applicant asserts that the application as originally filed teaches how to make and use the invention claimed in claim 43 without undue experimentation, as discussed *supra*.

35 U.S.C. § 112, Second Paragraph Rejection – Indefiniteness

Claims 21-48 (“Thin-walled”)

Claims 21-48 stand rejected under 35 U.S.C. § 112, second paragraph, as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The Office action indicated that “[i]n claim 21, line 4; and in claim 36 , line 3; use of the phrase ‘thin-walled’ makes the claim indefinite as to what thickness of the wall is required to met this claim limitation.” Office action at p. 3, ¶ 4. Applicant traverses and requests reconsideration. The Office action fails to set forth any reasoning or rationale for the rejection. For example, the Office action does not address the critical question of whether one of ordinary skill in the art, in view of the prior art and the status of the art, would nevertheless reasonably be apprised of the scope of the invention. *See* MPEP 2173.05(b).

Applicant asserts that the term “thin-walled insert” would be clearly understood in the context of a firearm barrel by those skilled in the art. Prior patents of Chestnut (US 4,769,938) and others describe the use of thin-walled rifled liners for firearm barrels in combination with other components to achieve a light weight barrel design. The Background section of the present application also states that:

“One approach to manufacture a light weight firearm barrel has involved the use of a rifled liner, or metal insert, wrapped in a protective material. Rifled liners are long metal inserts which are used to refurbish traditional metal rifle barrels in which the interior of the barrel has been damaged or worn over time. The rifled liners are thin and very susceptible to bending.”

Specification at ¶ [0004]. The Office action says nothing about how the foregoing disclosure would be understood by one skilled in the art. Applicant believes that in the context of the specification the term “thin-walled insert” is sufficiently definite to apprise someone of skill in the art as to the scope of the claims. Accordingly, applicant respectfully traverses and requests reconsideration and withdrawal of the rejection.

Claim 21

The Office action also objects to the use of the terms “a breech portion” and “a muzzle portion” in claim 21, and inquires: “Portions of what are intended?” Office action at p. 3, ¶ 4. Applicant argues that it is clear from the specification that the “muzzle portion” and “breech portion” are portions of the overall firearm barrel assembly and skilled persons would understand this to be so. However, in an effort to address the examiner’s concern, claim 21 is amended to break up the first clause into three separate clauses and to delete the word “and” before the last of the three clauses. Applicant also wishes to note that the Office previously allowed the same “breech portion” and “muzzle portion” claim terminology in the parent applications, now U.S. Patent Nos. 6,497,065 and 6,758,004.

With respect to the Office action’s remark that the muzzle portion and breech portion “are clearly not portions of tubular sleeve 38 being composed of different materials and being structurally independent . . .” (Office action at p. 3, ¶ 4), applicant traverses. The Office action fails to identify anything in the specification that requires this distinction. Notwithstanding that the specification describes embodiments in which breech portion 18, muzzle portion 30, and sleeve 38 are separate parts, these parts may also be combined (especially if all were made of the same material), as would readily be understood by persons of skill in the art upon reading the specification. *See* Specification at ¶ [0015] (“Preferably, the muzzle 30 is made of a stiff, heat-resistant material, preferably stainless steel.”) and ¶ [0017] (“Preferably, the sleeve 38 is formed of a material such as aluminum, steel, carbon fiber or a strong polymeric material.”). *See also* Specification at ¶ [0020] (“the muzzle portion 30 may be omitted. Instead, the sleeve 38 may be extended to the end of the insert member 36.”).

Claim 48 (“light weight material”)

Further, the Office action indicates that “[i]n claim 48, use of the phrase ‘light weight’ makes the claim indefinite as to what weights are intended to be included or

excluded by such relative terminology.” Office action at p. 3, ¶ 4. Applicant respectfully traverses and requests reconsideration.

The Office action fails to include a proper rejection because it does not attempt to make a determination or even allege that a person of ordinary skill in the art, in view of the specification and the art would reasonably be apprised of the scope of the invention. MPEP 2173.05(b). The specification describes “light weight” materials as those that are less dense than traditional metals used to make firearm barrels. *See Specification at ¶ [0018] (top of p. 5).* This description gives meaning to the term light weight, as the kinds of metals traditionally used to make firearm barrels are well known and understood by persons of skill in the art. Moreover, claim 48 recites a Markush group of “light weight materials selected from the group consisting of (a) a polymer; (b) a copolymer; (c) a blend of polymer and carbon fibers; (d) a glass reinforced polymeric material; and (e) a fiberglass wrap.” The transition “consisting of” in the Markush group is properly interpreted as defining a closed set. Therefore the term “light weight material” is strictly limited to the five constituents of the Markush group and cannot render the claim indefinite.

35 U.S.C. § 102(b) Rejections

Smith '912

Claims 21-26 and 29 are rejected under 35 U.S.C. § 102(b) as allegedly being anticipated by U.S. Patent No. 5,600,912 of Smith (“Smith '912”). Applicant traverses and respectfully requests reconsideration.

With respect to claim 21, the Office action identifies items 20 and 22 of Smith '912 as corresponding to the claimed muzzle portion and breech portion, and items 16, 18 (outer portions) of Smith '912 as corresponding to the claimed casing. However, claim 21 requires “a casing that tightly connects the breech portion to the muzzle portion.” The Office action fails to identify where in Smith '912 it is taught or suggested that the alleged casing (16, 18 – outer portions) tightly connects item 20 of Smith '912 to item 21 of Smith '912. A fair reading of Smith '912 indicates otherwise. For example, Smith '912 states at column 3, lines 31-34, that “The muzzle piece 20 and the breech piece 22 are attached to the liner 12 to compress the elongate fibers 18 and the cured resin matrix material 16 along the bore axis.” (emphasis added) Smith '912 does not describe resin matrix 16/fibers 18 as connecting breech piece 22 to muzzle piece 20. Moreover, such a

connection would appear to be undesirable with respect to the preferred embodiments described by Smith '912, in which the muzzle piece 20 and breech piece 22 are screwed tightly onto the liner 12 to compress the elongate fibers 18 and the cured resin matrix 16 therebetween for purposes of stiffening the fibers. *See* Smith '912 at column 3, lines 33-35. Accordingly, applicant asserts that the Office action fails to make out a proper rejection of claim 21 over Smith '912 and respectfully requests withdrawal of the same.

Claims 22-26 and 29 depend from claim 21, thereby incorporating all of the limitations of claim 21. Accordingly, claims 22-26 and 29 are also patentable over Smith '912.

With respect to claim 24, the Office action also fails to identify where in Smith '912 it is taught to connect the insert member to the sleeve, as claimed, and applicant has been unable to identify any such teaching. Applicant respectfully asserts that the rejection of claim 24 over Smith '912 is improper and should be withdrawn.

With respect to claim 25, the Office action also fails to identify where Smith '912 teaches an insert member bonded to a sleeve with an adhesive material, as claimed, and applicant has been unable to identify any such teaching. Applicant respectfully asserts that the rejection of claim 25 over Smith '912 is improper and should be withdrawn.

With respect to claim 26, the Office action also fails to identify where Smith '912 teaches an insert member press fit into a sleeve, as claimed, and applicant has been unable to identify any such teaching. Applicant respectfully asserts that the rejection of claim 26 over Smith '912 is improper and should be withdrawn.

With respect to claim 29, the Office action identifies Fig. 1, ref. 28 of Smith '912 as teaching stems having serrations. Fig. 1 shows nothing remotely like serrations. Thus, the Office action fails to identify where Smith '912 teaches a breech portion including a stem having serrations, as claimed. Applicant, therefore, respectfully asserts that the rejection of claim 29 over Smith '912 is improper and should be withdrawn.

Manshel '243

Claims 21-24, 26-27, 29, and 32-33 are rejected under 35 U.S.C. § 102(b) as allegedly being anticipated by U.S. Patent No. 3,118, 243 of Manshel ("Manshel '243"). Applicant respectfully traverses this rejection and requests reconsideration.

The Office action asserts that item 6 in Figure 1 of Manshel '243 anticipates the "casing" element of claim 21. Manshel '243 describes a "sheath 6 [that is] formed of fiber glass strands" which "are bonded to each other and to the jacket 4" using a "suitable resin

binder.” Manshel ’243, column 2, lines 3 and 17-19. Manshel ’243 further discloses that “[t]he breach end of the jacket 4 is internally screw-threaded to receive a breach fitting 11 . . . [which] is externally screw-threaded.” *Id.* at lines 32-36. In addition, “[t]he muzzle end of the jacket 4 is externally screw-threaded to receive a muzzle fitting 12.” *Id.* at lines 38-39. Thus it is the jacket 4 of Manshel ’243, and not the sheath 6, that connects the breech fitting 11 to the muzzle fitting 12. In contradistinction, claim 21 requires “a casing that tightly connects the breech portion to the muzzle portion.” Therefore, the Office action has failed to make a *prima facie* case of unpatentability because sheath 6 does not tightly connect breech fitting 11 to muzzle fitting 12.

Having “a casing that tightly connects the breech portion to the muzzle portion” (quoting claim 21) is important in the context of the claim and represents a novel and unobvious element not disclosed or suggested by Manshel ’243. In some embodiments disclosed in the present application, the casing material shrinks during molding to thereby pull the breech portion and muzzle portion toward each other. A tension force may be created in the casing 40 in this manner and offset by a compression force in the sleeve 38 to thereby result in a firearm barrel that is resistant to bending under lateral loading. This can improve the accuracy of the firearm barrel. Because Manshel ’243 does not teach or suggest “a casing that tightly connects the breech portion to the muzzle portion”, as claimed, applicant respectfully submits that the rejection of claim 21 is improper and should be withdrawn.

Claims 22-24, 26-27, 29, and 32-33 depend from claim 21 thereby incorporating all of claim 21’s limitations. Accordingly claims 22-24, 26-27, 29, and 32-33 are similarly patentable over Manshel ’243. Moreover, the Office action fails to make any mention of where Manshel ’243 teaches the limitations of claims 24, 26-27, and 32-33. For this reason, applicant respectfully submits that the rejection of claims 24, 26-27, and 32-33 improper independently of the rejection of claim 21, and should therefore be withdrawn.

Fournier ’081 and Werner ’842

Claims 21-22, 24-32, 36-42, and 44-45 are rejected under 35 U.S.C. § 102(b) as allegedly being anticipated by U.S. Patent No. 5,028,081 of Fournier (“Fournier ’081”). In addition, claims 21-32, 36-42, 44-45, and 48 are rejected under 35 U.S.C. § 102(b) as allegedly being anticipated by U.S. Patent No. 4,507,842 of Werner (“Werner ’842”). Applicant respectfully traverses these rejections and requests reconsideration.

Claims 21 and 36 both claim a “firearm barrel,” as recited in the preambles thereof. Although the term “firearm barrel” appears in the preamble, it is “necessary to give life, meaning, and vitality” to the claim. Therefore, the claim preamble should be construed as if in the balance of the claim. *Pitney Bowes, Inc. v. Hewlett-Packard Co.*, 182 F.3d 1298, 1305, 51 USPQ2d 1161, 1165-66 (Fed. Cir. 1999). See also MPEP 2111.02, citing *Kropa v. Robie*, 187 F.2d 150, 152, 88 USPQ 478, 481 (CCPA 1951). In *Kropa* the preamble of the claim recited “An abrasive article”, which was deemed essential to point out the invention defined by the claims as comprising abrasive grains and a hardened binder. The *Kropa* court stated “it is only by that [preamble] phrase that it can be known that the subject matter defined by the claims is comprised as an abrasive article.” *Id.* Similarly, in this application it is only by the preamble phrase “a firearm barrel” that it can be known that the subject matter of the claims is a firearm barrel. (Although the claimed “breech portion” and “muzzle portion” could be construed to suggest the same.)

Both Fournier ’081 and Werner ’842 concern pipe joints and neither discloses a firearm barrel. Moreover, contrary to what the Office action states, applicant argues that neither Fournier ’081 nor Werner ’842 discloses a muzzle portion or a breech portion as those terms are properly understood in the context of the specification. Furthermore, the pipes and pipe joints of Fournier ’081 and Werner ’842 would not be capable of performing as a firearm barrel. Compare *In re Schreiber*, 128 F.3d 1473, 1477, 44 USPQ2d 1429, 1431 (Fed. Cir. 1997) (oil can spout would be capable of dispensing popcorn in manner set forth in appellant’s claim to a dispensing top for dispensing popcorn). Accordingly, applicant asserts that claims 21-22, 24-32, 36-42, and 44-45 are patentable over Fournier ’081 and claims 21-32, 36-42, 44-45, and 48 are patentable over Werner ’842. Applicant respectfully submits that the rejections over Fournier ’081 and Werner ’842 should therefore be withdrawn.

Other Claim Amendments

Claim 24 is amended to correct a typographical error.

Conclusion

Applicant believes the application is in condition for allowance and requests the same.

Applicant wishes to respectfully remind the examiner of the guidance of the MPEP that before making a final rejection:

“all outstanding grounds for rejection of record should be carefully reviewed, and any such grounds relied on in the final rejection should be reiterated. They must also be clearly developed to such an extent that applicant may readily judge the advisability of an appeal unless a single previous Office action contains a complete statement supporting the rejection.”

MPEP 706.07. Applicant believes that the issues and grounds for rejection have not yet been clearly developed. This may be due, in part, to the large number of grounds for rejection cited. Applicant is appreciative of the challenges faced by the Office when examining an application in a relatively crowded field. However, in the event that any of the grounds of rejection in this Office action are maintained, applicant would appreciate having a complete and clearly developed statement of the rejection made on the record in a non-final action, such that applicant may have a meaningful opportunity to respond to the rejection.

The examiner is invited to telephone the undersigned if any issues remain.

Respectfully submitted,

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MAKROBLEND® UT1018

Polycarbonate/PET Polyester Blend

General-Purpose Grade

Product Information

Effective Date: 7/2002

Description

Makroblend UT1018 resin is an impact-modified blend of Makrolon® polycarbonate and polyethylene terephthalate (PET) polyester, combining the physical toughness of polycarbonate with the outstanding chemical resistance of PET. It provides excellent chemical resistance, outstanding low-temperature impact strength, and exceptional dimensional stability, even in high-moisture environments. Its fatigue endurance and abrasion resistance are superior to that of polycarbonate. The naturally glossy finish of Makroblend UT1018 resin provides an attractive surface that requires no painting. The resin is opaque and is supplied in pellet form for injection molding or extrusion.

Applications

Of all the grades in the family of Makroblend resins, Makroblend UT1018 resin has the greatest chemical resistance. In Bayer in-house testing, it withstood repeated intermittent exposure to numerous chemicals, such as gasoline, acids, automotive fluids, detergents, salt, and garden chemicals. Makroblend UT1018 resin also exhibits excellent impact strength, with a notched Izod impact strength of 8 ft·lb/in at -40°F (-40°C)*. These features give it potential for demanding applications in a variety of markets, such as lawn and garden, sporting goods, industrial/mechanical, electrical/electronic, and automotive. The excellent flowability of Makroblend UT1018 resin makes it possible to mold both large and small parts with variable wall thicknesses, ribs, bosses, and sharp corners.

Typical industrial applications include automatic teller machine housings, geophone housings, impellers, and salt water buoys. In the lawn and garden market, Makroblend UT1018 resin is used in snowblower impellers and components; tractor hoods, shrouds, and grills; and lawnmower chutes and hand tool housings. Sporting goods applications include protective face guards, football cleats, and skiing and boating equipment. As with any product, use of Makroblend UT1018 resin in a given application must be tested (including but not limited to field testing) in advance by the user to determine suitability.

Drying

Drying the resin before processing is essential to optimize property performance and appearance in molded parts. A desiccant dehumidifying hopper dryer is recommended. To achieve a moisture content ≤0.01%, inlet air temperature should be 220°–230°F (104°–110°C) for quantities less than 600 lbs and 190°–200°F max (88°–93°C max) for quantities of 600 lbs or more. Inlet air dew point should be -20°F (-29°C) or lower. The hopper capacity should be sufficient to provide a minimum residence time of 4–6 hours. Total drying time should not exceed 36 hours. Additional information on drying may be found in the Bayer brochure, *General Drying Guide*.

Processing

Makroblend UT1018 resin can be processed on commercially available equipment for injection molding or extrusion. Typical processing conditions for injection molding are noted below. Actual processing conditions will depend on machine size, mold design, material residence time, and shot size.

Typical Injection Molding Conditions

Barrel Temperatures:	
Rear	470°–490°F (243°–254°C)
Middle	480°–500°F (249°–260°C)
Front	490°–510°F (254°–266°C)
Nozzle	495°–515°F (257°–268°C)
Melt Temperature	500°–530°F (260°–277°C)
Mold Temperature	65°–165°F (18°–74°C)
Injection Pressure	10,000–20,000 psi
Hold Pressure	50–75% of Injection Pressure
Back Pressure	50–100 psi
Screw Speed	40–70 rpm
Injection Speed	Slow to Moderate
Cushion	1/8–1/4 in
Clamp	3–5 ton/in ²

Additional information on processing may be obtained by consulting the Bayer publication *Makroblend Polycarbonate Blend — Injection Molding Guidelines* and by contacting a Bayer MaterialScience technical service representative.

* This item is provided as general information only. It is an approximate value and is not part of the product specifications.

Regrind Usage

Where end-use requirements permit, up to 20% Makroblend resin regrind may be used with virgin material, provided that the material is kept free of contamination and is properly dried (see section on Drying). Any regrind used must be generated from properly molded/extruded parts, sprues, runners, trimmings, and/or film. All regrind used must be clean, uncontaminated, and thoroughly blended with virgin resin prior to drying and processing. Under no circumstances should degraded, discolored, or contaminated material be used for regrind. Materials of this type should be properly discarded.

Improperly mixed and/or dried regrind may diminish the desired properties of Makroblend resin. It is critical that you test finished parts produced with any amount of regrind to ensure that your end-use performance requirements are fully met. Regulatory or testing organizations (e.g., UL) may have specific requirements limiting the allowable amount of regrind. Because third party regrind generally does not have a traceable heat history, or offer any assurance that proper temperatures, conditions, and/or materials were used in processing, extreme caution must be exercised in buying and using regrind from third parties.

The use of regrind material should be avoided entirely in those applications where resin properties equivalent to virgin material are required, including but not limited to color quality, impact strength, resin purity, and/or load-bearing performance.

Health and Safety Information

Appropriate literature has been assembled which provides information concerning the health and safety precautions that must be observed when handling Makroblend UT1018 resin. Before working with this product, you must read and become familiar with the available information on its hazards, proper use, and handling. This cannot be overemphasized. Information is available in several forms, e.g., material safety data sheets and product labels. Consult your Bayer MaterialScience representative or contact Bayer's Product Safety and Regulatory Affairs Department in Pittsburgh, Pa.

Typical Properties* for Natural Resin	ASTM Test Method (Other)	Makroblend® UT1018 Resin	
		U.S. Conventional	SI Metric
General			
Specific Gravity	D 792	1.22	1.22 g/cm³
Density	D 792	0.044 lb/in³	0.82 cm³/g
Specific Volume	D 792	22.7 in³/lb	0.006–0.009 mm/mm
Mold Shrinkage	D 955	0.006–0.009 in/in	0.006–0.009 mm/mm
Water Absorption, Immersion at 73°F (23°C): 24 Hours	D 570	0.16%	
Equilibrium		0.30%	
Melt Flow Rate: ^a at 265°C/5-kg Load	D 1238	8–12 g/10 min	
Spiral Flow Length, 0.100-in (2.54-mm) Thickness: 525°F (274°C) Melt Temperature	(Bayer)	16 in	41 cm
Mechanical			
Tensile Stress at Yield	D 638	7,000 lb/in²	48 MPa
Tensile Stress at Break	D 638	7,600 lb/in²	52 MPa
Tensile Elongation at Yield	D 638	5%	
Tensile Elongation at Break	D 638	165%	
Flexural Stress at 5% Strain	D 790	10,700 lb/in²	74 MPa
Flexural Modulus	D 790	300,000 lb/in²	2.1 GPa
Impact Strength, Notched Izod: 0.125-in (3.2-mm) Thickness	D 256		
73°F (23°C)		18 ft·lb/in	961 J/m
-20°F (-29°C)		13 ft·lb/in	694 J/m
-40°F (-40°C)		8 ft·lb/in	427 J/m
0.250-in (6.4-mm) Thickness			
73°F (23°C)		15 ft·lb/in	801 J/m
Instrumented Impact, Total Energy: ^b	D 3763		
73°F (23°C)		39 ft·lb	53 J
-20°F (-29°C)		39 ft·lb	53 J
-40°F (-40°C)		38 ft·lb	52 J
Rockwell Hardness, R Scale	D 785	114	
Thermal			
Deflection Temperature, Unannealed: 0.250-in (6.4-mm) Thickness	D 648		
264-psi (1.82-MPa) Load		190°F	88°C
66-psi (0.46-MPa) Load		239°F	115°C
Coefficient of Linear Thermal Expansion	D 696	4.0 E-05 in/in/°F	7.2 E-05 mm/mm/°C
Relative Temperature Index: 1.47-mm (0.058-in) Thickness	(UL746B)		
Electrical		75°C	
Mechanical with Impact		75°C	
Mechanical without Impact		75°C	
Flammability**			
UL94 Flame Class:	(UL94)		
1.5-mm (0.059-in) Thickness		HB Rating	
3.0-mm (0.118-in) Thickness		HB Rating	
Weatherability			
UV Light Exposure and Hot Water Immersion Tests	(UL746C Sections 61 & 62)		
		f2 Rating	
Electrical			
Volume Resistivity (Tinfoil Electrodes)	D 257	>2.6 E+15 ohm·cm	
Dielectric Strength (Short Time under Oil at 73°F [23°C] and 0.062-in [1.57-mm] Thickness)	D 149	713 V/mil	28 kV/mm
Dielectric Constant (Tinfoil Electrodes), 1 MHz	D 150	3.06	
Dissipation Factor (Tinfoil Electrodes), 1 MHz	D 150	0.014	

* These items are provided as general information only. They are approximate values and are not part of the product specifications.

** Flammability results are based on small-scale laboratory tests for purposes of relative comparison and are not intended to reflect the hazards presented by this or any other material under actual fire conditions.

^a For information on using melt flow as a quality control procedure, see the Bayer publication, Makroblend Polycarbonate Blend — Injection Molding Guidelines.

^b 0.125-in thickness, 0.5-in dart, 3-in clamp, 15 mph.

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